CAPSULAR BAG IMPLANTS WITH DUAL 360 RING STRUCTURES FOR INHIBITING POSTERIOR CAPSULAR OPACIFICATION

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my prior U.S. patent application Ser. No. 08/060,636, filed May 12, 1993, now U.S. Pat. No. 5,366,501 issued Nov. 22, 1994, and entitled "Intraocular Lens With Dual 360° Haptics."

INTRODUCTION

This invention relates to posterior chamber implants, and in particular to such devices which are designed for in-the-bag implantation, i.e., implantation in the residual capsular bag of an eye, following an extracapsular cataract extraction. To the extent necessary for an understanding of the present invention, the background disclosures of the aforesaid prior application, if not fully set forth herein, are incorporated herein by this reference.

BACKGROUND OF THE INVENTION

Human beings, especially elderly persons, frequently tend to lose vision due to a gradually increasing clouding of the natural lens of the eye, which results from the development of a degree of opacity or clouding of the fibers (the cortex) surrounding the inert nucleus of the natural lens within the capsular bag housing the same, i.e., between the anterior and posterior capsules of the bag (the anterior capsule is the wall of the bag which is closer to the cornea, and the posterior capsule is the wall of the bag which is closer to the retina). The condition where this opacity spreads into the center of the lens in the region behind the pupil so as to impair vision, is designated cataract. When the opacity has progressed sufficiently to cause the loss of useful functional vision, the cataract is said to be mature, and the only currently available treatment for that condition is the removal of the cataract by extraction of the natural lens from the eye and the replacement of the natural lens by an artificial lens.

Merely by way of definition, a cataract removal, if it entails an extraction of the entire lens (including the nucleus, the cortex (the fibers) and the enveloping capsular bag) as a unit, is identified as an intracapsular cataract extraction (ICCE). On the other hand, a cataract removal which entails an extraction of only the lens nucleus and the cortex from the endogenous capsular bag through an opening formed by cutting away the mid-region of the anterior capsule and leaves in place only that residual part of the capsular bag which consists of the posterior capsule and the remaining annular anterior capsular flap, is identified as an extracapsular cataract extraction (ECCE).

The usual follow-up to an ECCE is the implantation of an artificial intraocular lens (IOL) into the posterior chamber of the eye (the anterior chamber is the space between the cornea and the iris while the posterior chamber is the space between the iris and the capsular bag), with the haptics of the IOL then being seated either in the ciliary sulcus outside and just anteriorly of the residual capsular bag and posteriorly of the iris, so that the entire residual capsular bag isolates the IOL from the vitreous humor, or physically within the residual capsular bag at the equatorial region thereof where the anterior capsular flap adjoins the posterior capsule, so that only the posterior capsule of the residual capsular bag isolates the IOL from the vitreous humor. There are, of course, many types of IOLs, designed for implantation into

either the anterior chamber or the posterior chamber of the eye, which over the years have been developed and available to eye surgeons for use in cataract surgery (representative ones are shown in Kelman U.S. Pat. Nos. 4,092,743, 4,174,543 and 4,608,049; Hoffer U.S. Pat. No. 4,244,060; Poler U.S. Pat. No. 4,402,579; Siepser U.S. Pat. No. 4,556,998; Ginsberg et al. U.S. Pat. No. 4,562,600; Mazzocco U.S. Pat. No. 4,573,998; Sayano et al. U.S. Pat. No. 4,681,585; Smith U.S. Pat. No. 4,704,123; Anis U.S. Pat. No. 4,795,460; Goldberg et al. U.S. Pat. No. 4,806,382; and Choyce U.K. Pat. No. 2,081,469), but since the designs and other features of most of these lenses are by and large not germane to the present invention, they will not be further discussed in detail herein.

While posterior chamber IOLs have proven to be of great benefit to persons who have undergone an ECCE, some post-operative complications do occasionally arise in connection therewith. As mentioned in my prior application Ser. No. 08/060,636, one such complication is a post-implantation clouding of the posterior capsule which is a consequence of the fact that some epithelial cells are almost invariably left in the equatorial region of the capsular bag and not removed therefrom during the irrigation and aspiration phase after the surgeon has extracted the cataract. These cells have a tendency to migrate over the anterior surface of the posterior capsule toward the center or optic region thereof and, upon accumulating there, lead to capsular fibrosis and the formation of Elschnig's pearls, which in turn causes opacification of the posterior capsule and ultimately impairs vision in the same manner as the original cataract did, namely, by blocking the passage of light through the capsule to the retina. To remedy this situation, a further surgical procedure then becomes necessary, which may involve scraping and cleaning the accumulated fibers from the anterior surface of the posterior capsule behind the implanted IOL and possibly even a cutting out of the opacified region of the posterior capsule by means of a laser capsulotomy (which of late has substantially supplanted knife discission as the standard operating procedure). In any event, the possibility that the patient may be traumatized or even develop retinal detachment by such a procedure, coming after the patient has already gone through two losses of vision and one or two surgical procedures (the ECCE and the IOL implantation), is a prospect to be avoided.

The problems of capsular fibrosis and formation of Elschnig's pearls and of the resultant opacification of the posterior capsule following an ECCE have been recognized in the technical and patent literature; see, for example, the discussions thereof in the aforementioned U.S. Pat. Nos. 4,244,060 (Hoffer) and 4,562,600 (Ginsberg et al.). However, neither the ridged Hoffer lens nor the flanged Ginsberg lens described in those patents has been successful in eliminating these problems, in essence for the reason that in each of these lens designs one or more recesses are formed in the ridge or flange which projects posteriorly from the lens optic and is in contact with the front or anterior surface of the posterior capsule once the IOL has been implanted. Hoffer taught that such recesses (which are designated by reference numeral 34 in U.S. Pat. No. 4,244,060) are useful because they facilitate performance of a knife discission of a clouded posterior capsule without necessitating a dislodgement of the IOL. Ginsberg et al. taught that such recesses (which are designated by reference numerals 34 and 36 in U.S. Pat. No. 4,562,600) are useful because they facilitate rotational positioning of the IOL during the initial implant surgery and also minimize the post-implantation occurrence of unwanted and disturbing light reflections into the visual